



Ischemia and Infarction

INTENDED LEARNING OBJECTIVES (ILO)



By the end of this lecture the student will be able to:

- 1. List causes and effects of acute & chronic ischemia**
- 2. Differentiate between causes and pathological features of types of infarction**

Ischemia



:Definition

.Reduction of arterial blood supply to a tissue

Two



Sudden

closure



Causes of acute ischemia



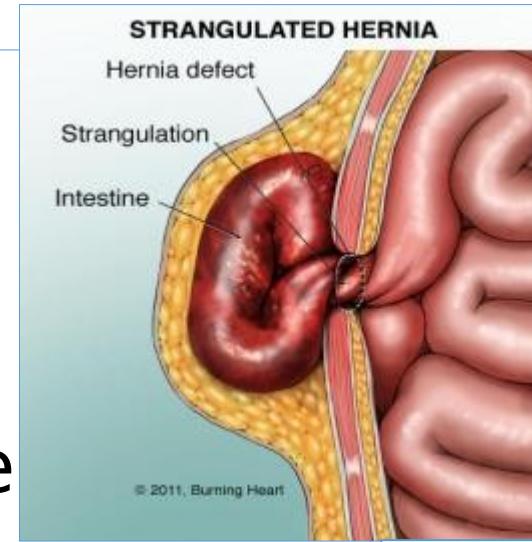
Causes of acute ischemia

1. Thrombus or embolus

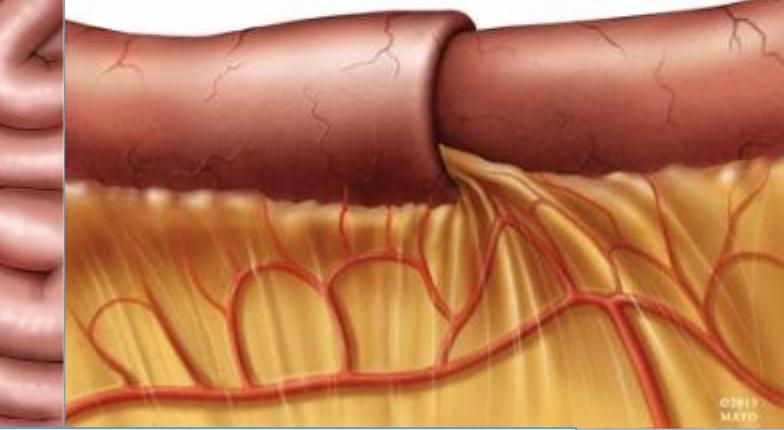
2. Strangulation of vessels

as occlusion of intestinal vessels

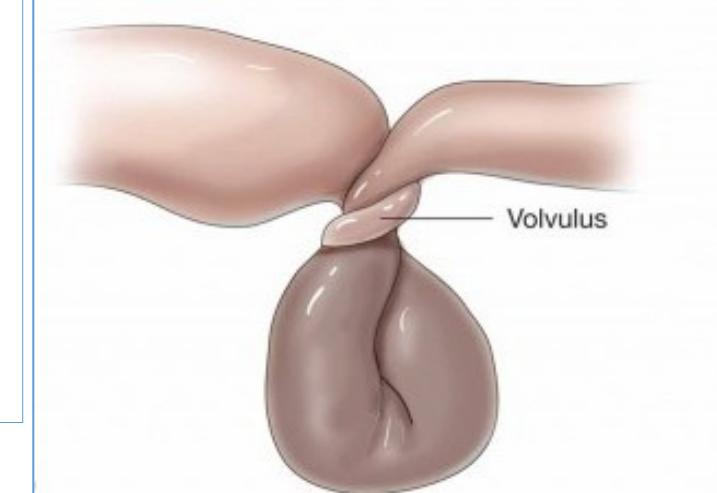
- Strangulated hernia
- Intussusception
- Volvulus



Intussusception



3. Surgical ligature of an artery



Causes of acute ischemia



4. Buerger's disease: Thrombangitis obliterans

- In heavy smoker middle aged **males**
Due to inflammatory occlusion of blood vessels
---> pain, tissue damage, and even gangrene



Buerger's disease



Raynaud's disease

5. Raynaud's disease:

- In young **females**
- Due to spasmodic attacks of small arteries & arterioles due to cold or

Causes of acute ischemia



6. Ergot poisoning:

- Severe arterial spasm as a result of vasoconstriction □ dry gangrene

7. Extensive venous obstruction

- Marked engorgement of venous

capillary blood flow causes the
arterial blood flow



09/11/2022

A



B



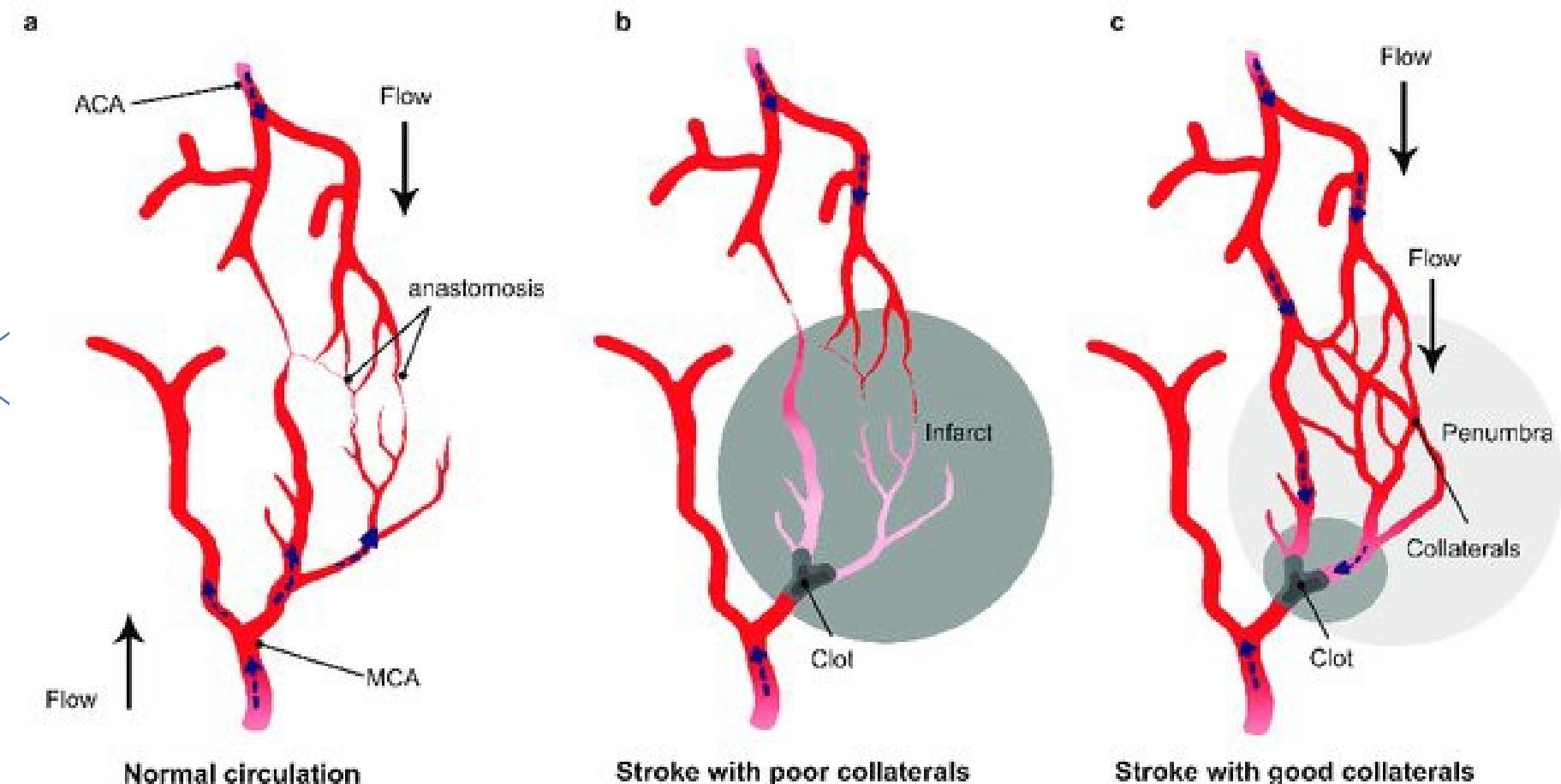
Ergot poisoning



Effects of acute ischemia



Sudden
occlusion of
an artery
with

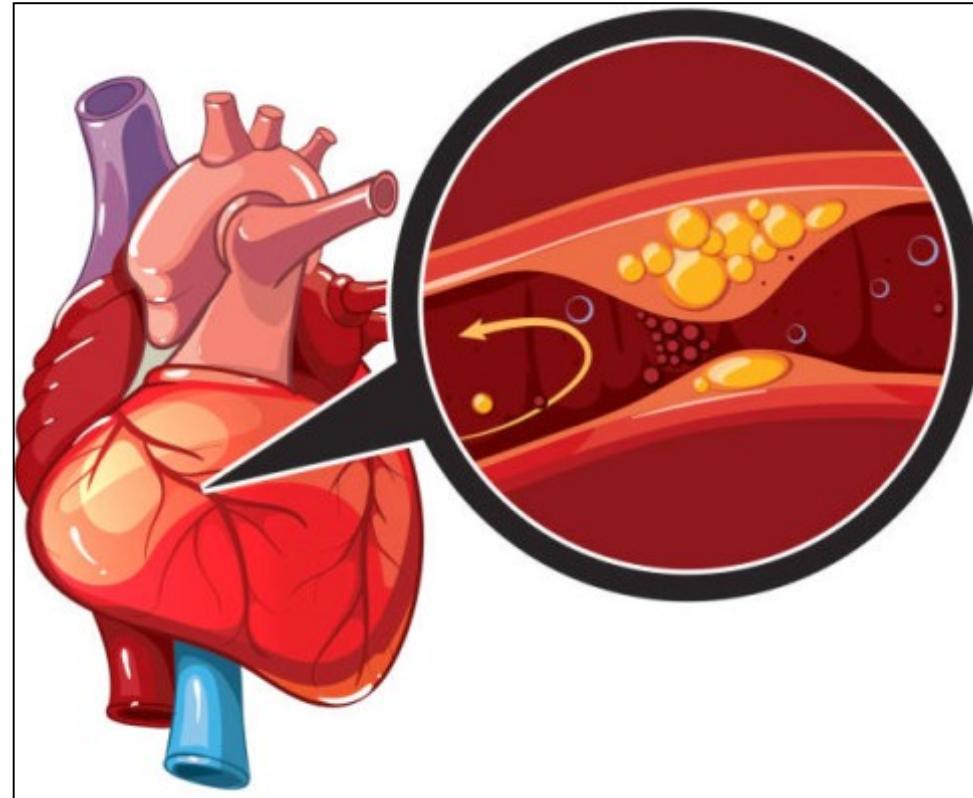


Chronic ischemia



Causes:

1. Atherosclerosis
2. Arterial compression e.g by tumours



Chronic ischemia



Effects:



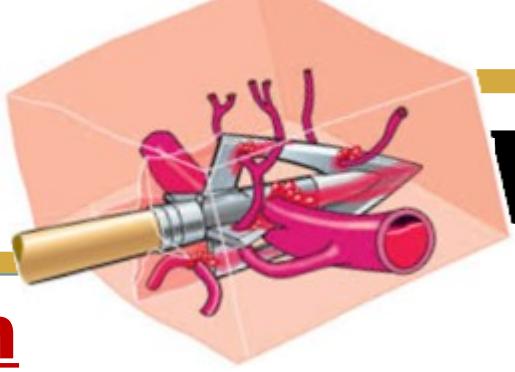
Ischemia (Quiz)



List causes of acute ischemia?

Thrombus or embolus-1

- Strangulation of vessels-2
- Surgical ligature of an artery-3
- Buerger's disease-4
- Raynaud's disease -5
- Ergot poisoning -6
- Extensive venous obstruction-7



Infarction



Definition

□ An infarct is an area of ischemic necrosis caused by **sudden** occlusion of the vascular supply to the affected tissue.

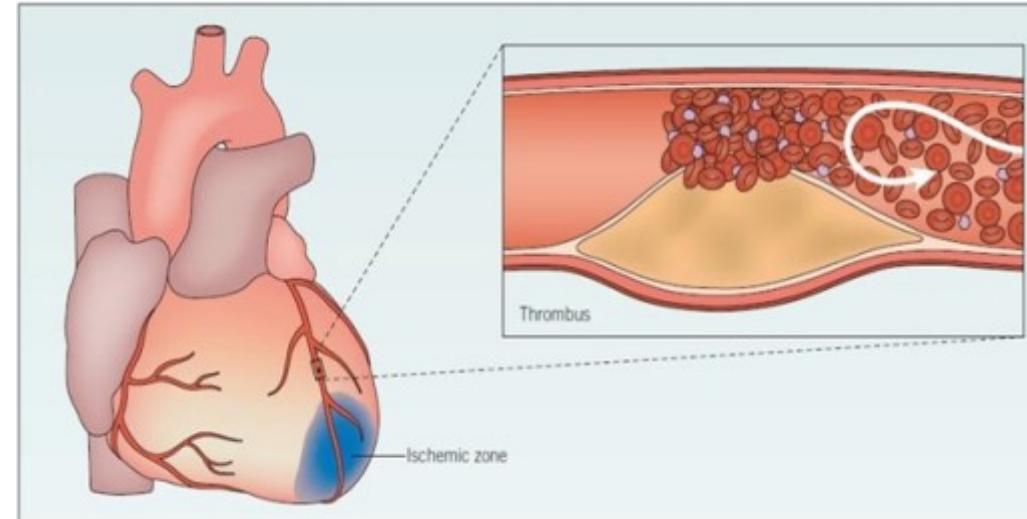
Aetiology

Arterial occlusion by thrombus -1 or embolus :**99%** of cases

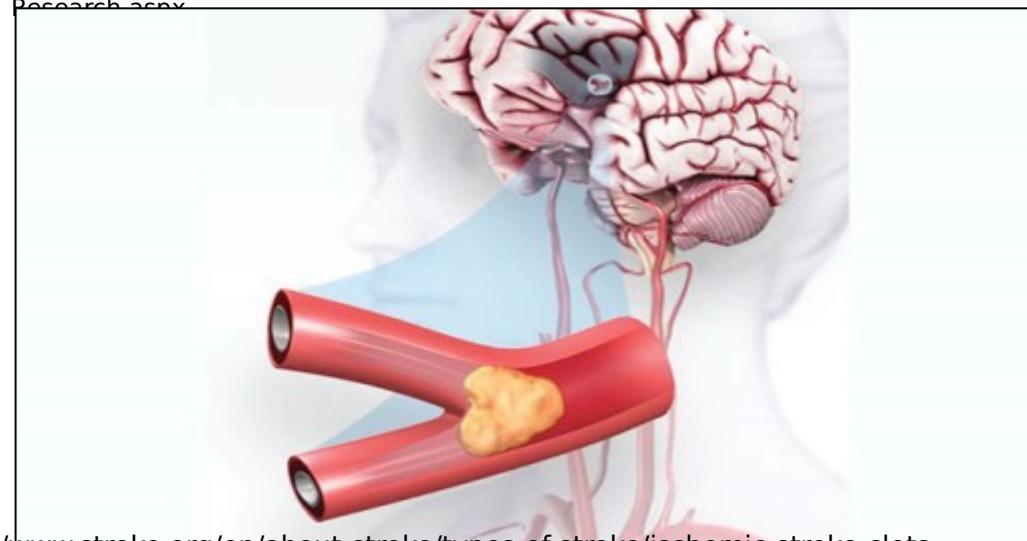
Less common causes include -2

- ✓ Vasospasm
- ✓ Extensive **venous** occlusion

09/11/2024



<https://www.news-medical.net/whitepaper/20190909/Myocardial-Infarction-Cardiovascular-Research.aspx>



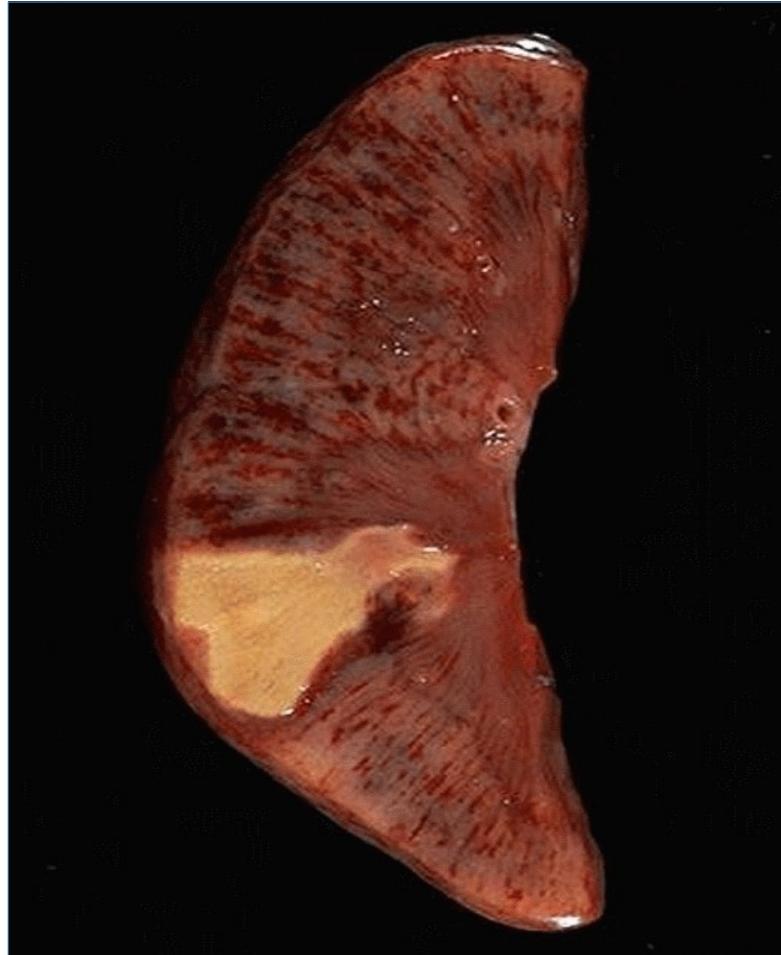
<https://www.stroke.org/en/about-stroke/types-of-stroke/ischemic-stroke-clots>



Infarction

Types of infarct

What is the difference?



Kidney



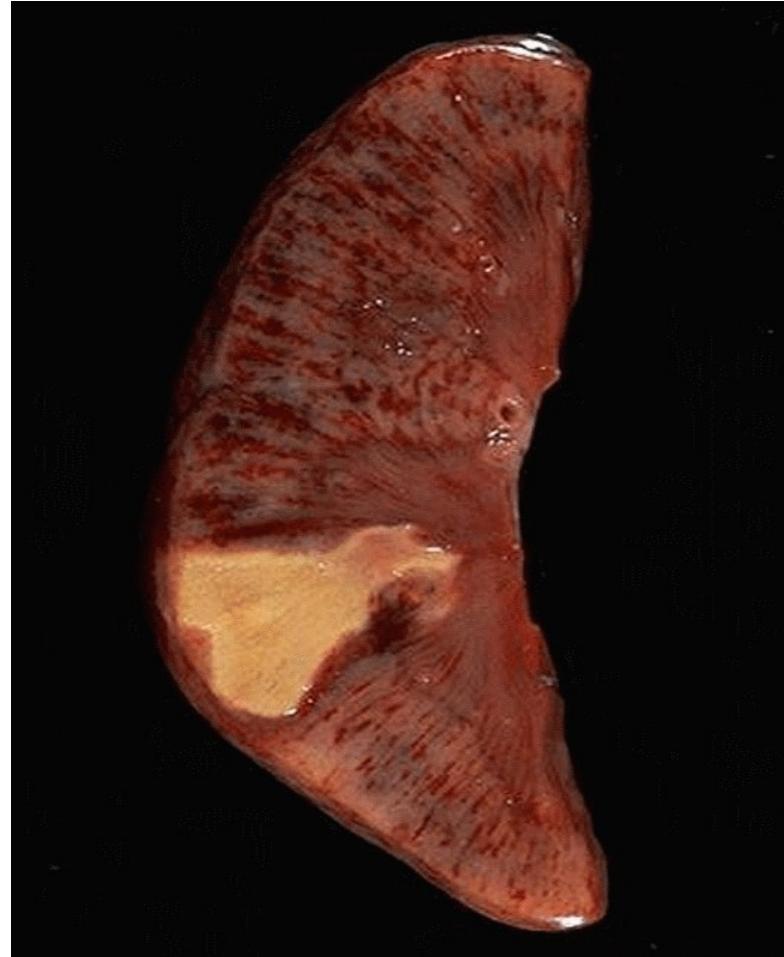
Lung



Infarction

Types of infarct

- Pale
- Red
- hemorrhagic**

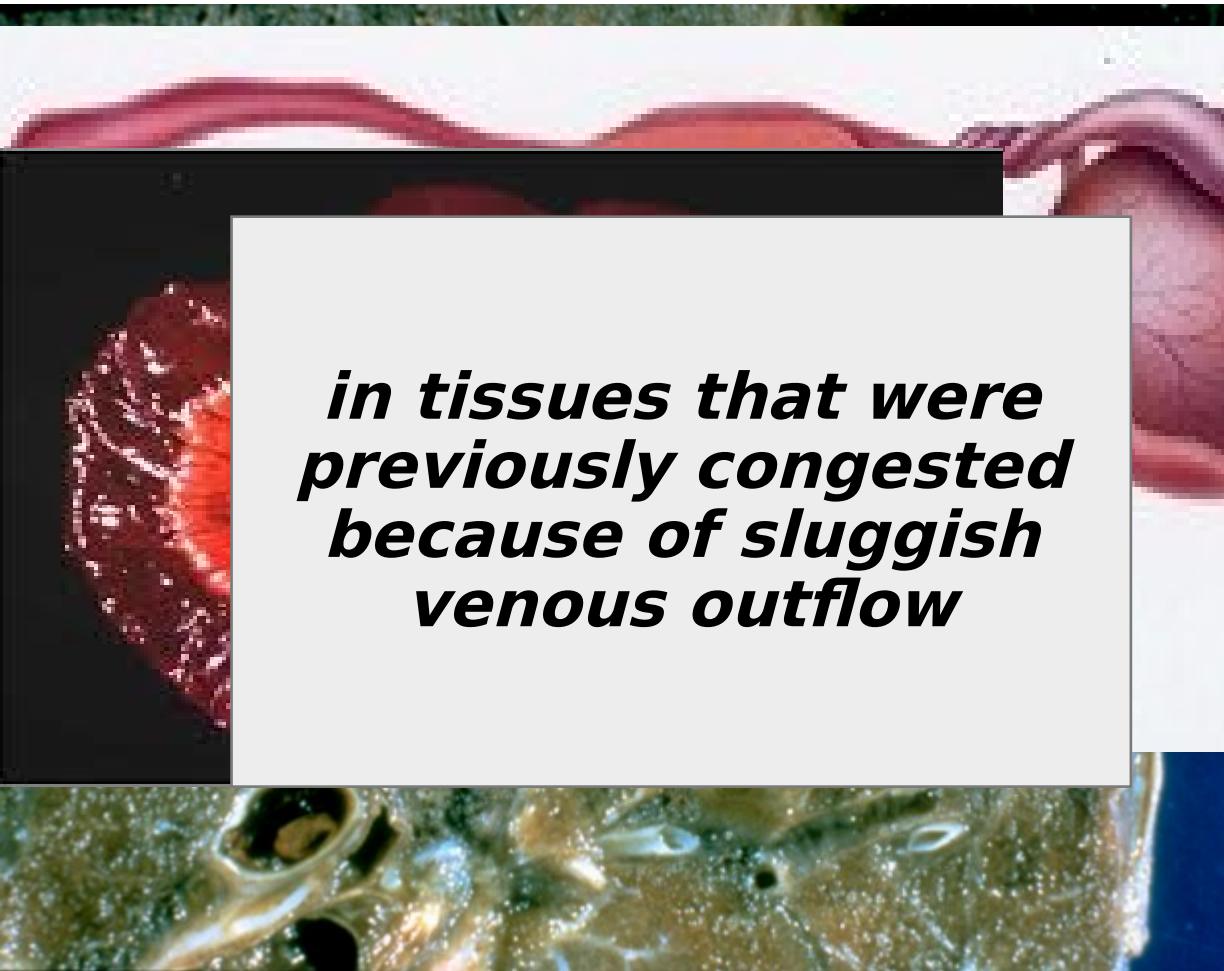


Pale (KIDNEY)

A-Pale infarcts occur with

- Arterial occlusion in solid organs with end arteries
 - e.g heart & kidney and spleen

Types of infarction/ Red infarction



is such as to d



Types of infarction

B-Red hemorrhagic infarcts occur in

Venous occlusions (with or without arterial occlusion) as in

- Strangulated hernia (**intestine**)
- **Ovarian** or **testicular** torsion
- **Brain** infarction due to jugular vein thrombosis

loose tissues

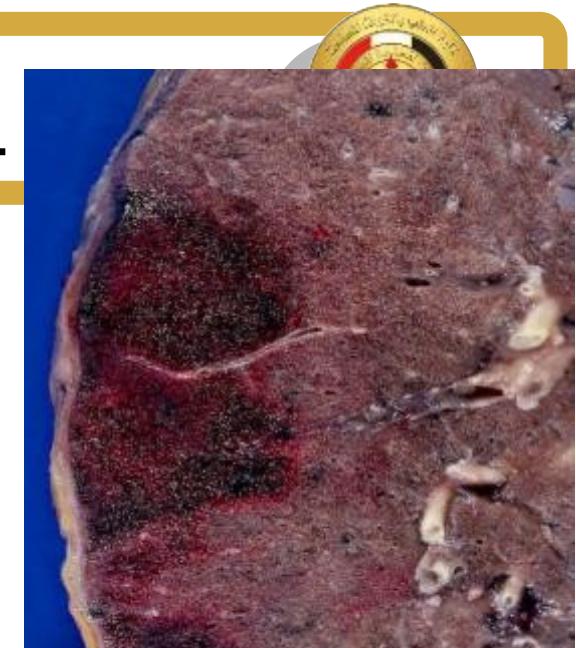
as lung and small intestine where blood can collect in infarcted zone.



Types of infarction

Previously congested tissues

(as a consequence of sluggish venous outflow).



https://www.wikiwand.com/en/Hemorrhagic_infarct

Tissues with a dual circulation

e.g. lung, liver and small intestine permitting blood flow from the patent vessels into infarcted area

(such perfusion not sufficient to rescue the ischemic tissues).



Examples of infarction



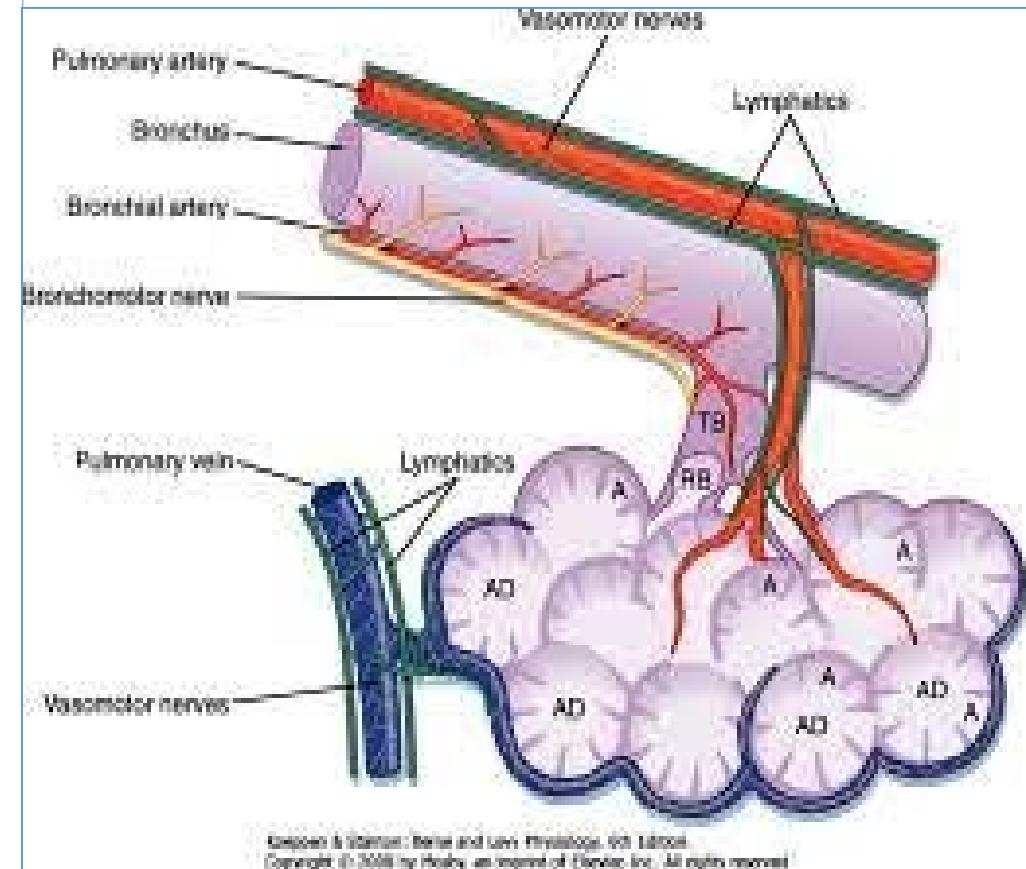
Lung infarction: hemorrhagic-1 infarction

Etiology

❑ Lung has **double blood supply** so infarction does not occur unless both pulmonary & bronchial arteries are affected.

➤ **Pulmonary artery occlusion** is by thrombosis or embolism

➤ **Inefficient bronchial blood**



Kapoor & Bhutani: Basic and Clinical Physiology, 6th Edition
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Examples of infarction



N:B:

- ✓ **Lung congestion** is caused either by mitral stenosis or left ventricular failure

- ✓ These diseases that cause lung congestion simultaneously lead to **low cardiac output** → inefficient bronchial blood flow

Clinical features

- Chest pain
- Hemoptysis

Examples of infarction



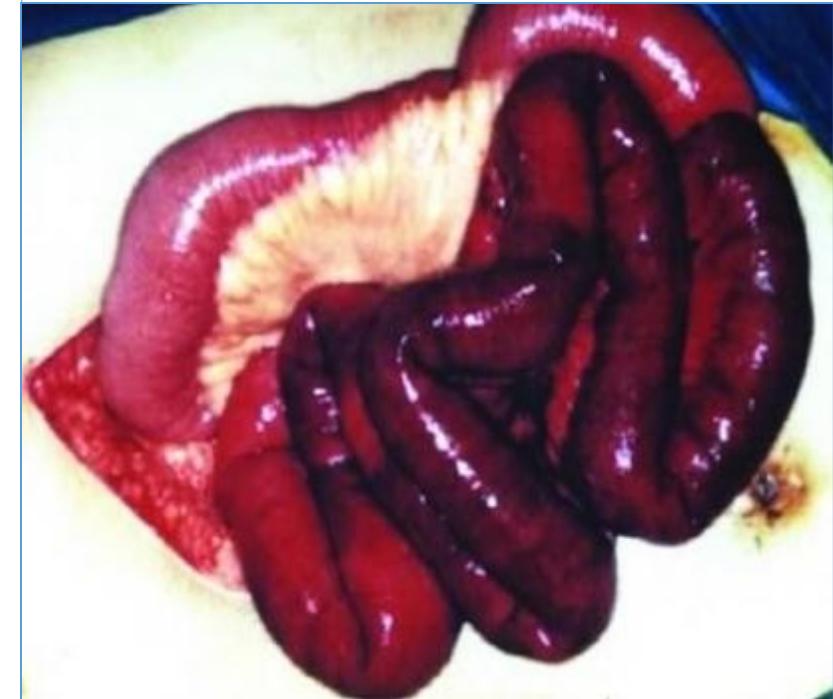
Intestinal infarction: hemorrhagic-2 infarction

Aetiology

- Occlusion of mesenteric arteries by thrombus or emboli
- Intestinal strangulation

Progresses to

Gangrene due to putrefaction by intestinal bacteria



Examples of infarction



3-Cerebral infarction

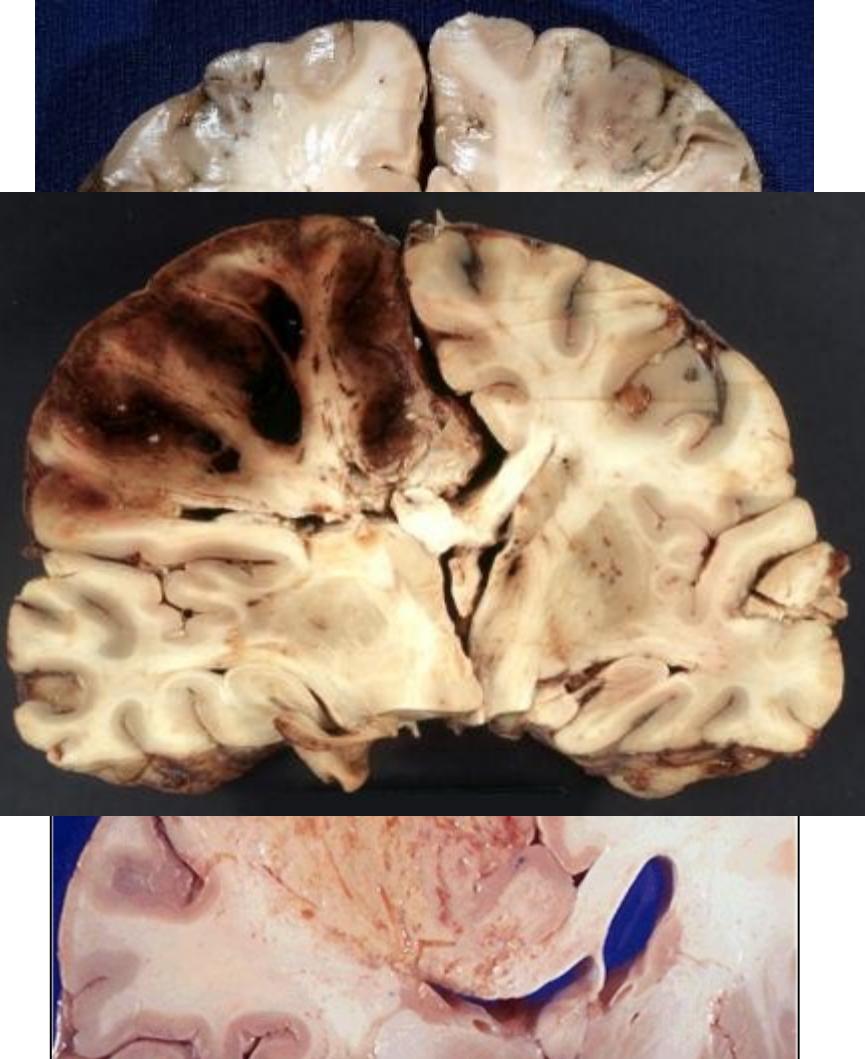
Brain infarcts may be

- Pale** due to thrombotic or embolic arterial occlusion
- Hemorrhagic** due to venous occlusion (jugular vein thrombosis)

Clinical effects

Vary according to site of infarction

- Hemiplegia
- Some other cases may be fatal

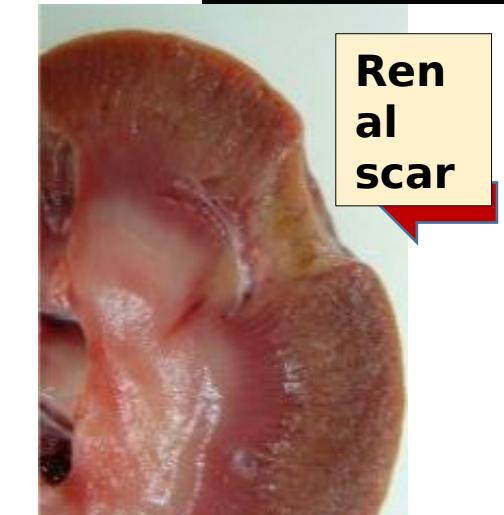
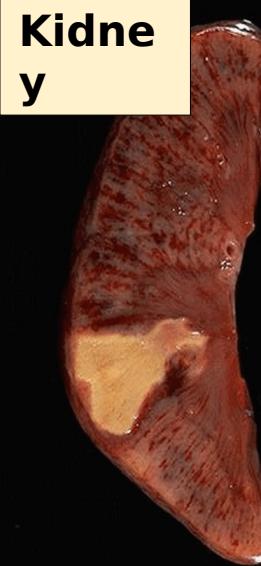


Pathological features of infarction



Gross features

- Pyramidal or wedge** shaped infarct with
 - ✓ its ***apex*** at the site of vascular occlusion
 - ✓ its ***base*** at surface of the organ due to the fan shaped distribution of end arterioles
- When the **infarct base** is a serosal surface; pleura, pericardium, peritoneum → it shows fibrinous inflammation
- Margins** of the infarct are **hyperemic** due to inflammation
- Early**, the infarct is **swollen** but **later**, it becomes **contracted** due to healing
- Infarcts may be **pale** or **hemorrhagic**



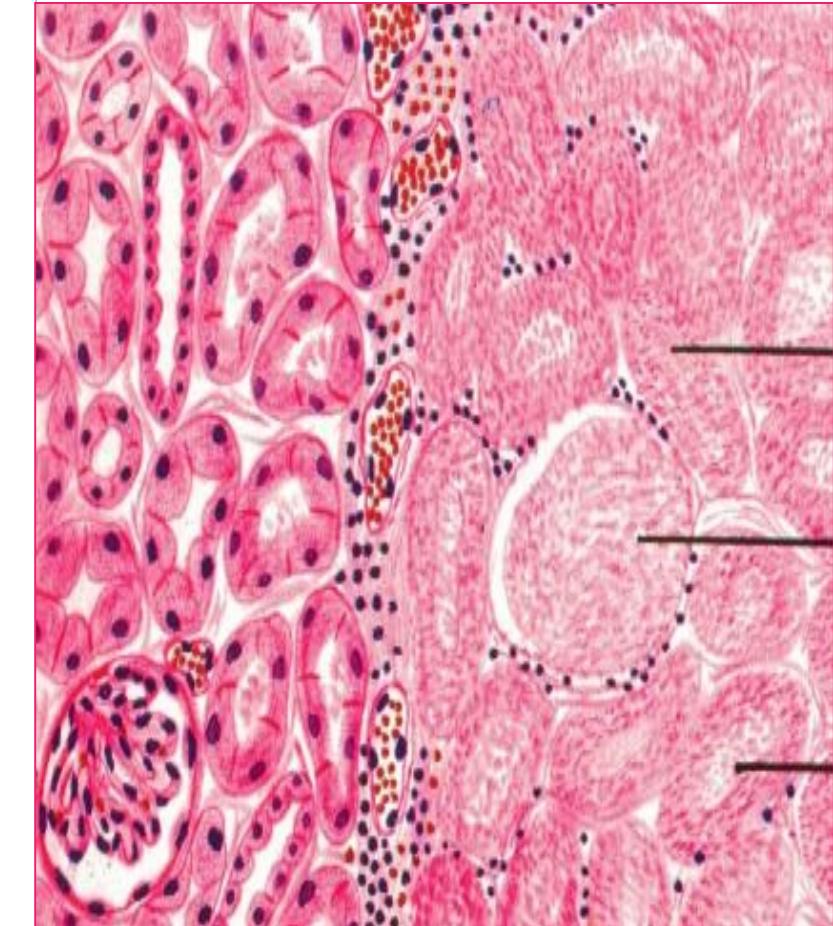
Pathological features of infarction



Microscopic features

- **Infarcts** of all organs → ischemic
Coagulative necrosis
EXCEPT CNS → liquefactive necrosis
- **The margins** of the infarct show dilated capillaries & some inflammatory cells.
- **The rest of the organ** appears normal except in case of lung infarction where the **lung** is congested

coagulative necrosis in kidney



Infarction (Quiz)



Which of the following types of infarction may be followed by gangrene

- A. Cerebral infarction**
- B. Intestinal infarction**
- C. Myocardial infarction**
- D. Renal infarction**
- E. Splenic infarction**

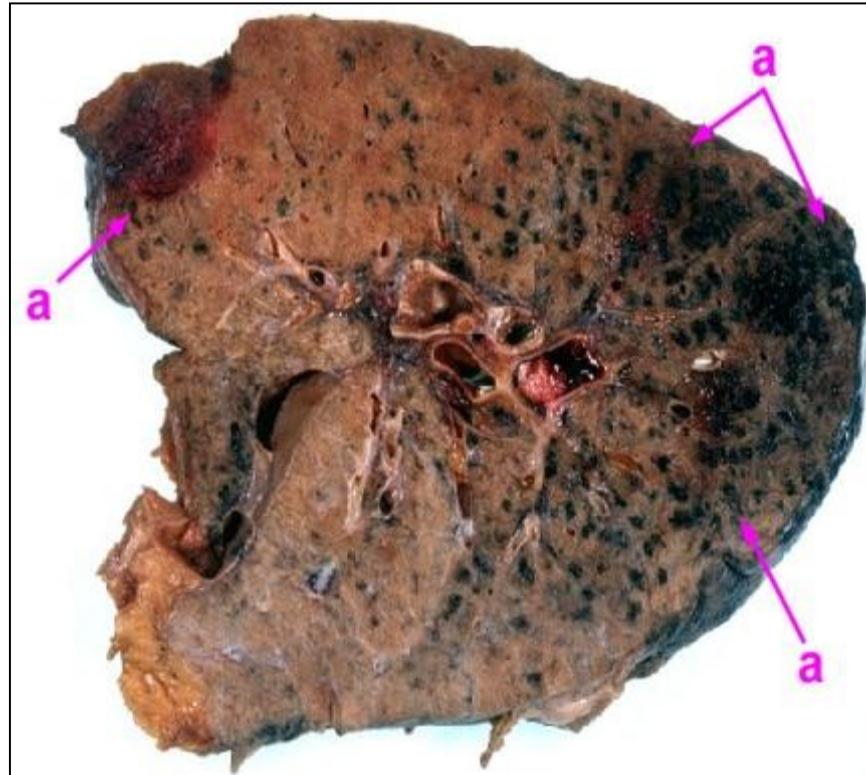
Infarction (Quiz)



**What is the
abnormality in
this picture &
what is the
most common
cause?**



Infarction (Quiz)



- **Pulmonary infarction** with a medium-large sized embolus and obstructs a medium-sized pulmonary artery branch. If the patient has any underlying cardiovascular disease it will lead to **infarction**. This would present clinically with **haemoptysis**.

Infarction (Quiz)



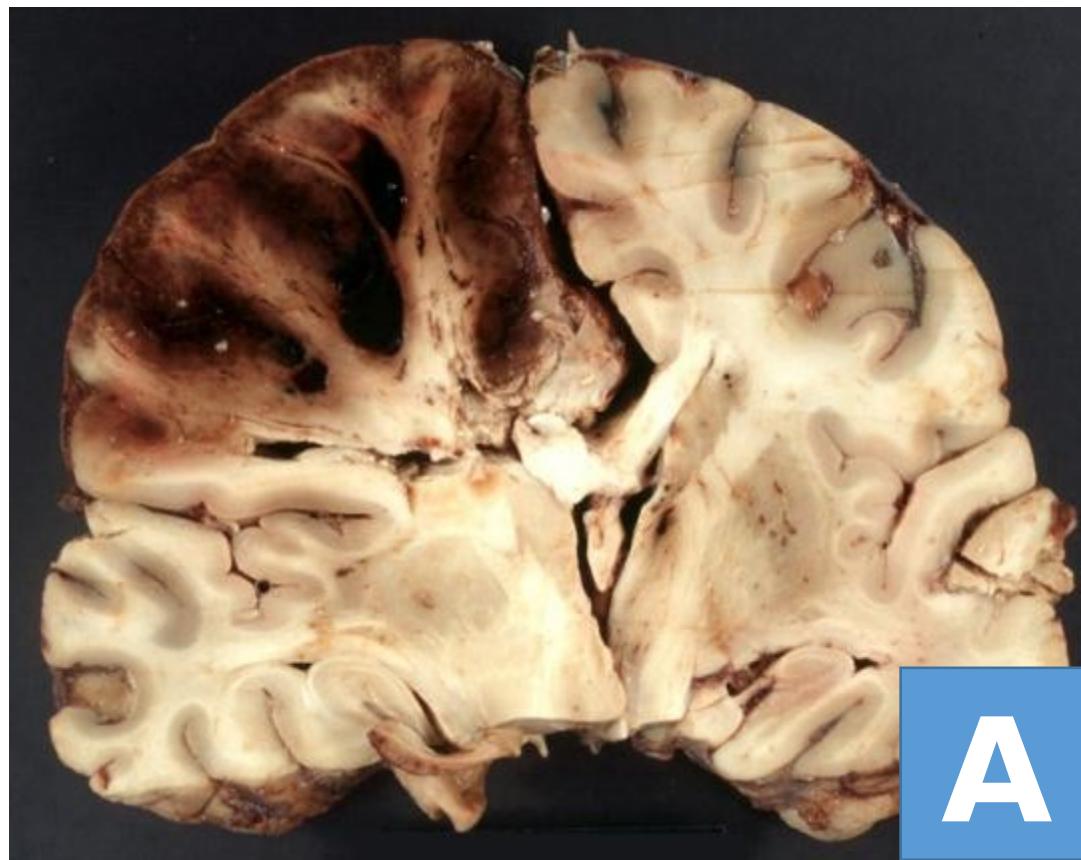
A 17-year-old married woman presented with seizures. She was confused on admission. She had headache persistent for the last 2 weeks. She vomited intermittently for last 7 days. Past medical, and family histories were unremarkable. She did not experience neck trauma or repetitive neck compressions. She was on oral contraceptives.

CT scan of the brain and has shown a large brown area in the left frontal lobe antero-inferiorly, with minimal oedema of the surrounding brain parenchyma

Infarction (Quiz)



For this clinical history which of the following is the most closely associated gross pathologic finding? Justify???



A



B

27

Infarction (Quiz)



There is a specific type of necrosis that occurs in the brain after an infarction. What is the name of this necrosis?





- **Key points:** Acute ischemia results from sudden complete arterial occlusion, while chronic ischemia results from gradual incomplete arterial occlusion
- Infarction may be pale or red
- Pale infarction occurs due to arterial occlusion in solid organs with end arteries
- Red infarction occurs in previously congested organs, loose tissues, with venous occlusion and tissues with dual blood supply
- The infarct is pyramidal or wedge shaped with base^{90, 1024}

Suggested Textbooks



1. Robbins basic pathology; 10th edition from page 114 to 119
2. <https://webpath.med.utah.edu/webpath.html>



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Thanks!
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